



COMPARATIVE STUDY OF CARRYING ANGLE BETWEEN MALES AND FEMALES IN RURAL AND URBAN POPULATION OF HIMACHAL PRADESH

Anatomy

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ABSTRACT

Background- The carrying angle of the elbow is the measurement of varus- valgus angulation of the arm with the elbow and has been found dependant on the age, gender, height, hyper extensive movements at elbow and intertrochanteric distance. This study aims to assess the difference in carrying angle between males and females in urban and rural population due to difference in working conditions and lifestyle. **METHODS-** This study reviewed the sex wise variation in the difference of carrying angle in 626 participants of urban and rural area. **RESULTS-** Carrying angle was greater in females residing in rural areas compared to the females in urban population which was statistically significant. Among males, the overall carrying angle was more in rural population than urban population but this difference was statistically not significant. **CONCLUSION-** This study concludes greater carrying angle in population residing in rural areas compared to their urban counterparts.

KEYWORDS

Carrying angle, urban and rural population.

INTRODUCTION

The carrying angle of the elbow is the measurement of varus- valgus angulation of the arm with the elbow fully supinated⁽¹⁾. The intersection of the line along the mid-axis of the arm and the line along the mid-axis of the forearm defines this angle. This deviation of the forearm from the long axis of the arm is measured as carrying angle⁽²⁾. The carrying angle is caused partly by projection of the medial trochlear edge 6 mm beyond its lateral edge and partly by the obliquity of the superior articular surface of the coronoid, which is not orthogonal to the shaft of the ulna. Tilt of the humeral and ulnar articular surfaces is approximately equal; hence the carrying angle disappears in full flexion. This angle is important in walking, swinging, and carrying objects.

The angle has been found dependant on the age, gender, height, hyper extensive movements at elbow and intertrochanteric distance. The angle is observed increasing till 15 years and slight decrease after this age and this rate of increase in carrying angle in boys and girls is also found to be variable.⁽³⁾

The average angle in men is about 5°-10° whereas in women it is about 10° to 15°.^(4,5) Potter was the first to carry out a quantitative investigation on the obliquity between the arm and the fully extended and supinated forearm in humans with carrying angles of 6.83° and 12.65° for males and females respectively. Later on, other researchers found it significantly more in females than males.^(6,7,8) The greater angle in females has been considered to be a secondary sexual characteristic.^(6,9-12) However, some workers reported no significant difference in carrying angle of males and females of any age group.^(13,14-16) There is, however, extensive overlap in the carrying angle of men and women, and a sex-bias has not been consistently observed in scientific studies.^(14,17,18) It is speculated that this conflicting data produced is due to the variations in the population studied.⁽¹⁹⁾ The angle is greater in the dominant limb than in the non-dominant limb of both sexes, suggesting that natural forces acting on the elbow modify the carrying angle.^(19,20)

An increase in the carrying angle is abnormal, particularly if it occurs unilaterally. If the angle is increased beyond the average, it is called cubitus valgus.⁽¹⁵⁾ The knowledge of carrying angle is highly significant in the management of various types of fractures of the elbow and other elbow disorders that require reconstruction arthroplasties.^(21,22) The increase in carrying angle may lead to elbow instability, pain during exercise or in throwing activities⁽²²⁾ and may reduce the function of elbow flexion.⁽²¹⁾ There is increase evidence of elbow fracture when falling on the outstretched hand and fracture of the distal humeral epiphysis in subjects with wider carrying angle.⁽²²⁾

Natural forces performing at elbow are distinct in urban and rural population as working conditions and lifestyle is different. Thus exact knowledge of carrying angle is important for the management of the

various problems associated with elbow joint e.g. deviation towards or away from the midline, fracture at the joint and its correction, management of pain, or identification of the sex.

AIMS AND OBJECTIVES

To assess the difference in carrying angle between males and females in urban and rural population of Himachal Pradesh.

MATERIALS AND METHODS

The study was conducted on Rural and Urban population of Hamirpur District of Himachal Pradesh. It was a Cross sectional study with a sample size of 626 with males and females 15 years and above who consented to the study, without any congenital upper limb deformity and without any history of previous upper limb trauma were included in this study. Measurement was taken on the subjects wearing light clothes in relaxed standing anatomical position in the dominant limb. Bicipital Groove, biceps brachii tendon at its insertion and Palmaris longus tendon at the wrist were palpated and marked as anatomical landmarks to demarcate the median axis of arm and forearm respectively and carrying angle was calculated.



OBSERVATION AND RESULTS

Participants Profile

1. Gender distribution: Out of 626 participants, 363(57.9%) were female while 263(42.1%) were males.

Table-1: Gender distribution

Female	363	57.9%
Male	263	42.1%
Total	626	100%

2. Urban and rural distribution- Out of the total of 626 participants in the study, 311 belong to urban and 315 to rural area.

Table-2: Urban/rural distribution of population

Urban population	311	49.68%
Rural population	315	50.32%
Total	626	100%

Gender distribution- Out of the total of 311 urban population, 178 were females and 133 were males. Similarly among rural population 185 were females and 130 males respectively.

Table-3: Urban and rural distribution of study participants.

Gender distribution	Urban population	Rural population
Female	178	185
Male	133	130
Total	311	315

Carrying angle:

(A) The mean carrying angle in females and males was 12.87 +/- 3.68 and 12.46 +/- 3.06 respectively.

Table-4A Mean carrying angle in females and males.

Sex	Carrying angle (Mean +/- SD)
Female	12.87 +/- 3.68
Male	12.46 +/- 3.06

(B) The Mean of Carrying Angle of Urban female was 11.99 +/- 3.80 while that of Rural Female was 13.71 +/- 3.35.

Table-4B Mean of Carrying Angle of Urban and Rural females.

	Carrying angle (Mean +/- SD)	
	Urban	Rural
Female	11.99 ± 3.80	13.71 ± 3.35

(C) The Mean of Carrying Angle of Urban male was 12.14 +/- 2.90 while that of Rural male was 12.78 +/- 3.18.

Table-4C Mean of Carrying Angle of Urban and Rural males.

	Carrying angle (Mean +/- SD)	
	Urban	Rural
Male	12.14 ± 2.91	12.78 ± 3.18

(D) Comparison of Carrying angle among participants from rural and urban area- The Mean of Carrying Angle of Urban female was 11.99 ± 3.80 while that of Rural Female was 13.71 ± 3.35. The Mean of Carrying Angle of Urban male was 12.14 ± 2.90 while that of Rural male was 12.78 ± 3.18.

Table-4D: Comparing Carrying angle among participants from rural and urban area.

	Carrying angle (Mean +/- SD)		p- value
	Urban	Rural	
Female	11.99 ± 3.80	13.71 ± 3.35	0.01
Male	12.14 ± 2.90	12.78 ± 3.18	0.08

There was a statistically significant difference in the Mean Carrying angle of Urban and Rural Female participants which was more in later with a 'p' value of 0.01, whereas the 'p' value of Mean of Carrying Angle of males of urban and rural areas was 0.08 which was statistically not significant.

DISCUSSION

In the present study, out of the 626 individuals overall carrying angle was more in females compared to males but it was not statistically significant.

On sex wise comparison between the urban and rural population, carrying angle of rural female participants was statistically significantly greater than their urban counterparts.

Paraskevas G *et al.*⁽¹⁹⁾ studied carrying angle in 600 living individuals from Greece, aged 18–28 years. Carrying angle was significantly greater in females. Carrying angle was 12.23 ± 0.30 in males and 15.77 ± 0.410 in females. Maria *et al* observed mean CA for females to be 12.9 ± 3.95 and mean of CA for males 12.39 ± 3.64 with no statistical difference.⁽²³⁾ Steel FLD and Tomlinson JDW⁽¹⁴⁾ investigated the left upper limb of 100 European adults using radiographs to measure carrying angle and obtained no statistically significant difference (males 19.280 and females 18.380). Most of the study by different researchers showed that Carrying angle of females was greater than males^(9,11,23,24), however some researchers found no significant difference in carrying angle of male and female of any age group.^(14,15,16) In this study, overall increase in CA observed among females than males but the difference was not statistical significant.

The study conducted by Vaibhav Saini *et al* concluded that there was statistically significant difference in carrying angle among people residing in rural areas compared to the people of urban area.⁽²⁵⁾ The study conducted by Pawan K. Mahato *et al* also concluded that there was statistically significant difference between the carrying angle which was more in people residing in rural areas compared to their

urban counterparts.⁽²⁶⁾ This study also concluded that the people residing in rural areas has wider carrying compared to the population residing in urban area.

CONCLUSION

This study concludes that CA was greater in females residing in rural areas compared to the females in urban population which was statistically significant. Among males, the overall carrying angle was more in rural population than urban population but this difference was statistically not significant. This study also fails to find the statistical significant difference of variation in carrying angle among male and female population.

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